

CLAIMS

1. An electrode comprises at least a first metal layer and a second metal layer comprising; wherein

the electrode is formed on a semiconductor film which formed on a substrate, and

5 the first metal layer and the second metal layer sequentially formed on the semiconductor film in this order, and

the electrode in ohmic contact with the semiconductor film with heat treatment at a temperature equal 40°C or more greater than the melting point of Al; wherein

10 a first metal material formed the first metal layer is comprised of Al, and

a eutectic alloy formed of the first metal material and a second metal material forming the second metal layer has a melting point equal or greater than the temperature of the heat treatment, and

15 an alloy of the second metal material and Al starts to be formed at a temperature equal or greater than the melting point of Al.

2. The electrode according to claim 1, wherein the alloy of the second metal material and Al starts to be formed at a temperature equal or greater than the heat treatment temperature.

3. The electrode according to claim 1, wherein the temperature of the heat treatment is equal or greater than 800°C.

4. The electrode according to claim 1, wherein the melting point of the eutectic alloy is equal or greater than 1,100°C.
5. The electrode according to claim 1, wherein the second metal material forming the second metal layer comprises at least one metal selected from the group consisting of Nb, W, Fe, Hf, Re, Ta and Zr.
6. The electrode according to claim 1, wherein a third metal layer is interposed between the first metal layer and the second metal layer.
7. The electrode according to claim 5, wherein the third metal layer comprises an alloy formed of the first metal material and the second metal material.
8. The electrode according to claim 1, wherein the semiconductor film is a Group III nitride semiconductor film.
9. The electrode according to claim 1, wherein an intermediate metal layer is interposed between the first metal layer and the semiconductor film and
the intermediate metal layer comprises a metal material having a
5 melting point greater than the melting point of Al.
10. The electrode according to claim 9, wherein part or whole of the first metal layer comprises an alloy formed of the first metal material and the metal material constituting the intermediate metal layer.

11. The electrode according to claim 10, wherein the metal material constituting the intermediate metal layer comprises at least one metal selected from the group consisting of Ti, Nb, V, W, Ta, Re, Mo, Mn, Pt, Pd, Rh, Y and Zr.

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12. The electrode according to claim 11, wherein the intermediate layer comprises of Ti or Nb and the second metal layer is formed of Nb.

13. The electrode according to claim 1, wherein a third metal layer comprises of a third metal material having a melting point greater than the melting point of Al is further provided on the second metal layer.

14. The electrode according to claim 13, wherein the second metal material comprises of Nb and the third metal material is formed of Au.

15. A semiconductor device comprising a semiconductor film and an electrode formed on the semiconductor film, wherein the electrode is the electrode according to claim 1.

16. A method for manufacturing an electrode formed on a semiconductor film comprising:

forming a first metal film on the semiconductor film;

forming a second metal film; and

5 treating the first metal film and the first metal film with heat at a temperature 40°C or more greater than the melting point of Al,

wherein a eutectic alloy formed of the first metal film and the second

metal film has a melting point greater than the temperature of the heat treatment step, and an alloy of the second metal material and Al starts to be
10 formed at a temperature equal or greater than the melting point of Al.

17. The method for manufacturing an electrode according to claim 16, wherein the alloy of the second metal material and Al starts to be formed at a temperature equal or greater than the heat treatment temperature.